AD-A192 465 KNOWLEDGE ACQUISITION FOR EXPERT SYSTEMS IN CONSTRUCTION(U) LOUGHBOROUGH UNIV OF TECHNOLOGY (ENGLAND) DEPT OF CIVIL ENGINEERING E G TRIMBLE ET AL. 1/1

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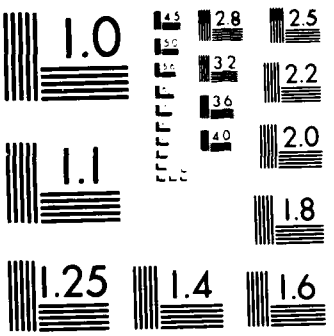

Report for the US Army research development and standardization group (UK).
Contract no. DAJA 45-85-C-0033
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Subject Knowledge acquisition for expert systems in Construction
Principal investigator Professor E G Trimble
Associated investigators Dr R J Allwood. Mr A E Bryman

SECOND INTERIM REPORT

(Covering the period 13 December 1985 to 31 March 1986)

Work to date

As expected Mr C N Cooper was appointed on 27 January 1986. Since then we have had further meetings with George Wimpey and Company. The main points emerging to date are:-

- In a system for the selection of handling equipment on multi-storey sites the key items for selection are cranes.
- The majority of cases will be buildings exceeding three storeys. It may be convenient to divide such projects into two phases namely sub-structure and superstructure. For the sub-structure a range of crane types is possible; for the super-structure it is likely that one or more tower cranes will be required.
- The key factor in determining the number of tower cranes is the "hook time" i.e. the estimate of time needed for lifting materials and plant. Our early impression is that a substantial amount of experiential knowledge goes into estimating this and that we can expect to develop an interesting knowledge base for this factor alone.
- The system must take account of the irregular three-dimensional geometry of the building(s) to be constructed. Some form of inter-active graphics facility will therefore be needed.

Once a decision has been made to use one or more tower cranes there remain the important decisions as to location(s), reach, capacity, climbing (internal or external), travelling or fixed, nature of foundations and temporary ties.

In addition to the selection of appropriate cranes, George Wimpey have selected two domains from those identified in our report to CERL(Contract DAJA45-84-C-0024 - Expert systems in contract management. A pilot study). These relate to the contractor's decision on whether or not to bid, and the contractor's procedure for evaluating the strength of his claims.

We have an offer of facilities for the "bid/no bid" domain from another contractor and are exploring the possibilities that this provides.

We have continued our tests on Expert-Ease applied to knowledge that was assembled in producing a system to diagnose the cause of dampness in buildings. These tests have led us to the conclusions that the approach is helpful as a discipline in ensuring that conditions are accurately defined. Contrary to our expectations it also allows probabilities to be explored provided that these are defined in wide bands e.g. P90 to mean probabilities in a range 0.75 to 1.00. The models derived from the data are strict hierarchies i.e. with none of the cross-connections we have come to expect from real world conditions. We have again found that small changes in data often lead to very large changes in the model; a condition that is bound to undermine the confidence of users. We are continuing our studies of the use of Expert Ease but are not giving this work a high priority.

We have identified and obtained access to eight examples of expert systems developed for the construction industry and have examined these by discussion with their originators. We have arrived at very tentative conclusions; namely

- In all cases the assembly of the knowledge base was undertaken on an ad hoc exploratory basis;
- There was little or no evidence of verification either in relation to the credibility of the domain expert or of the knowledge base once assembled;
- In only one case is the system likely to be used in the real world.

In view of the heavy predominance of development systems we believe that our construction industry cases do not provide an adequate sample from which to draw reliable conclusions. We therefore plan to extend our enquiries to any expert system that resembles in principle those we expect to develop ourselves. We believe it is safe to do this as the appropriate approach to knowledge acquisition we think is independent of the nature of the domain but dependendent on the system characteristics of the application coupled with the situation characteristics. We are endeavouring to identify the variables that define these characteristics in an attempt to provide guidance based on the observed profiles of application and situation.

Future work

Our future work will comprise a continuation of the current work described above. In summary this will be

- Work with George Wimpey & Company on cranes.
- Work on the bid/no bid domain
- Work on the evaluation of the strength of a contractor's claim

- An extension of the collection and analysis of case study material

A further point on which we can report only in tentative terms is that there is some evidence to suggest that the use of concrete pumping is less widespread in Britain than in continental Europe. It seems possible that, when we take costs into consideration, there may emerge pointers on the greater use of pumping which could lead to lower construction costs. We see this as a potential improvement of the domain expertize itself and are hopeful that future experience of expert system development may frequently have some beneficial spin-off in the form of better understanding of the domain.

In view of the difficulties in finding suitable case study material we shall consider alternative approaches for exploring the general characteristics of the Knowledge Acquisition process.

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